Forest Biodiversity in California: Principles, Planning, and Monitoring

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Biodiversity Sustainability
March 17, 2011

A definition..

U.S. Congress Office of Technology Assessment, "Technologies to Maintain Biological Diversity," 1987:

"Biological diversity is the variety and variability among living organisms and the ecological complexes in which they occur. ”

- Genetic
- Species
- Habitats
- Ecosystems

California by the numbers

Size: ~100M acres

~15% converted to urban or agricultural uses

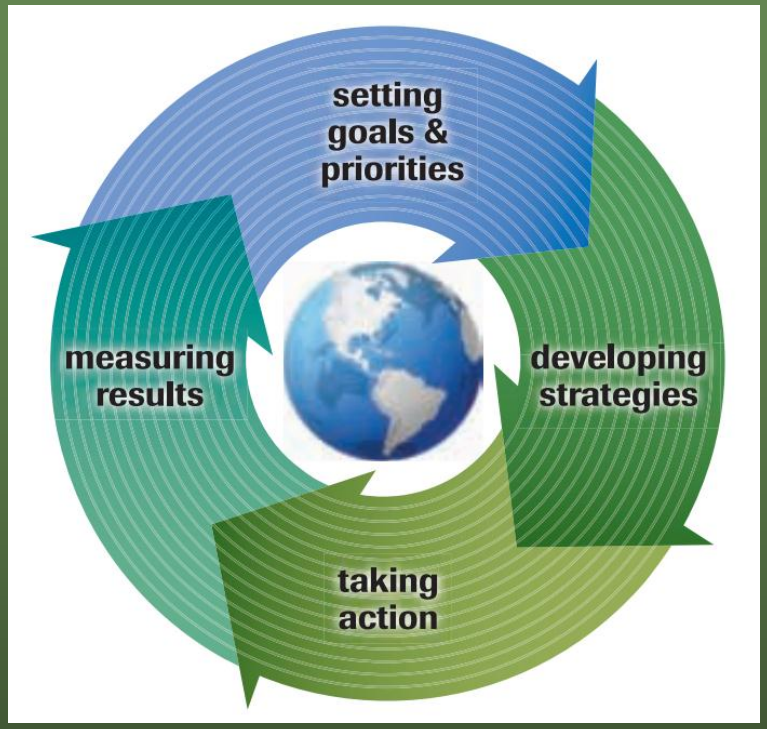
~ 18% in areas managed for wilderness, biodiversity

~34% in areas managed for multiple uses (often incl. natural resource)

	Total # CA	% of US	# Endemic	U.S. Rank	% At Risk Spp of US in CA
Vascular Plant Taxa	6272	32%	2153	1	32% (spp)
Amphibian Spp.	51	22%	17	1	23%
Reptile Spp.	84	30%	5	1	29%
Bird Spp.	433	56%	2	2	19%
Mammal Spp.	197	47%	17	1	41%
Freshwater Fish Spp.	67	8%	20	1	10%
Total	***7104***		***2214***		

Source: Atlas of the Biodiversity of California, CA DFG

Conservation Approach

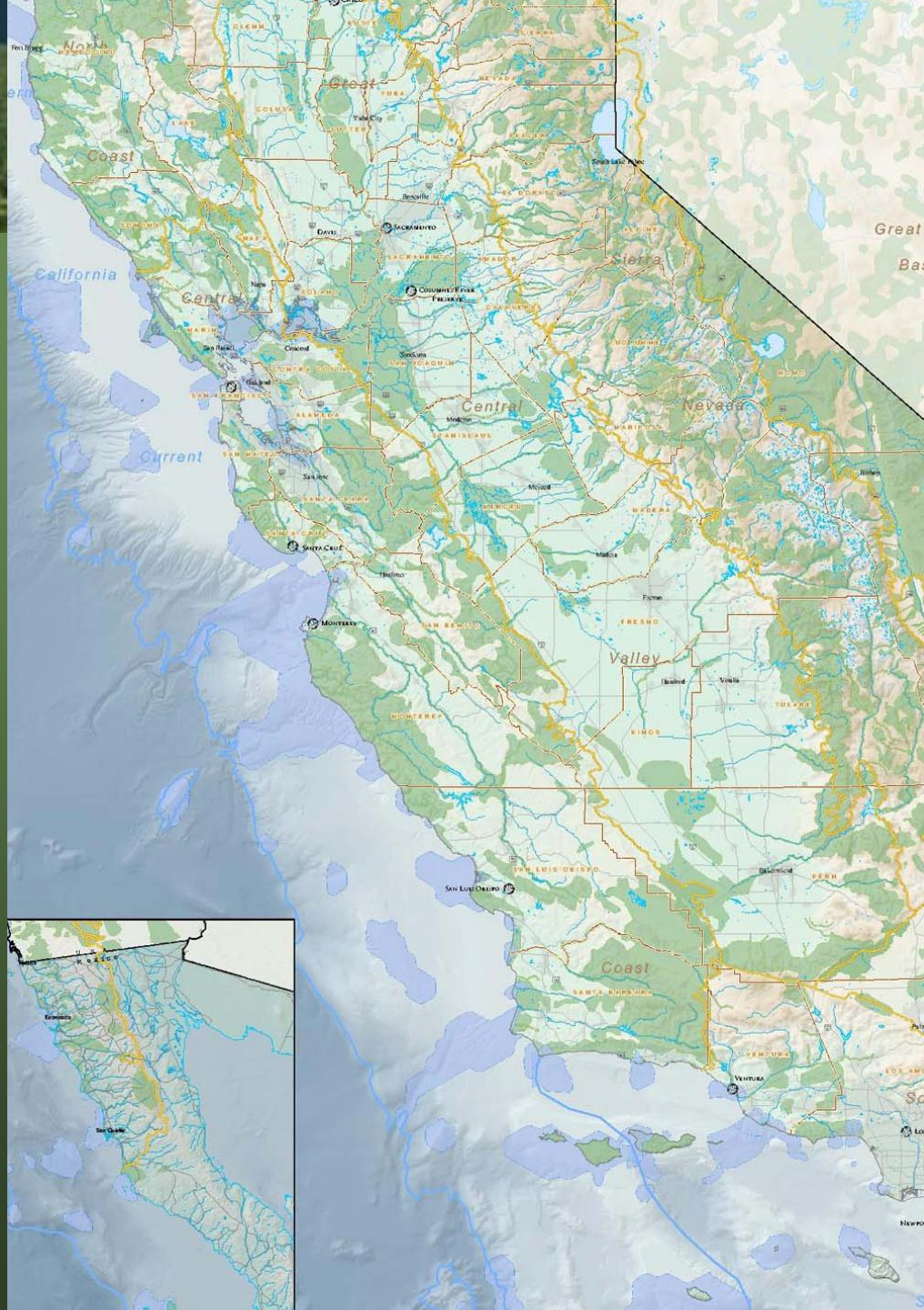


- Conservation by Design- TNC's approach to landscape scale conservation
- Applied in 30+ countries and 50 US states

The mission of The Nature Conservancy is to preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive.

Ecoregional planning -

- ”Systematic conservation planning”
- Identifies priority areas for conservation



Guiding Questions for Regional Assessments

1. What are your conservation targets (species, ecosystem services, vegetation systems)?
2. What are your goals (estimates of viability related to abundance, distribution)?
3. What is the current distribution of threats, suitability factors?
4. What factors will promote successful adaptation to climate change?
5. What is the projected future distribution of other threats that will affect options and viability?

Principles for planning in forests

To maintain biodiversity, plan for the maintenance of….

- Connectivity *(e.g. wildlife, plants nutrients, water)*
- Landscape heterogeneity *(diversity of structure and composition over large areas)*
- Stand structural complexity
- Integrity of aquatic systems by sustaining hydrologic and geomorphological processes

Lindenmayer and Franklin, Conserving Forest Biodiversity 2002

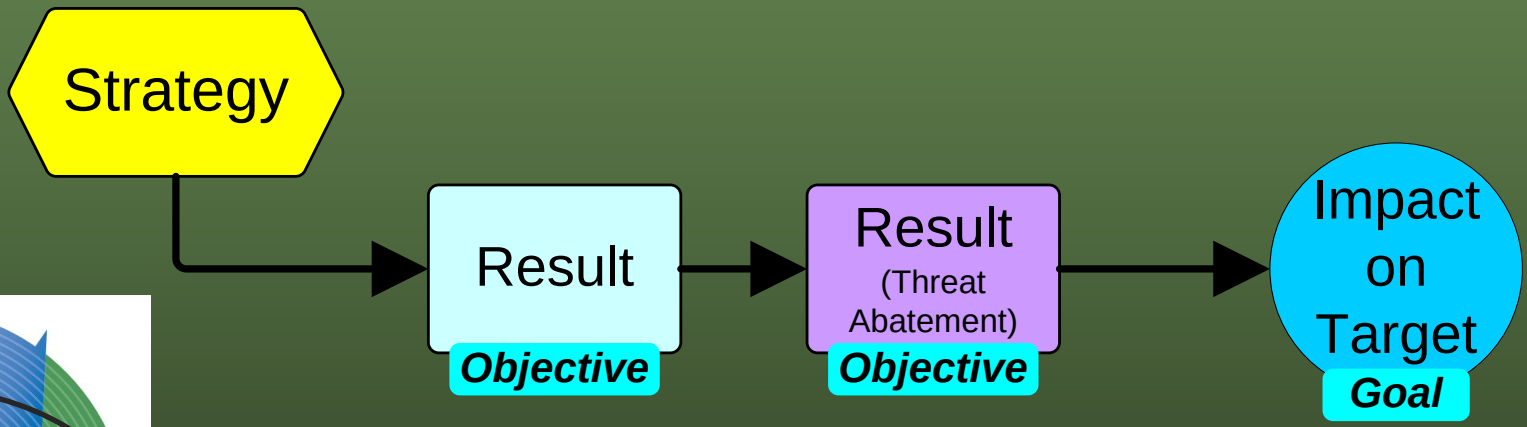
Role of disturbance

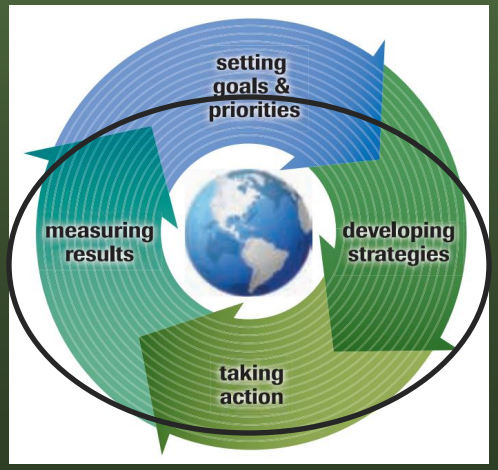
- Maintaining or mimicking natural disturbance frequency and patterns
- Monitoring effect of actions on species and processes provides basis for adaptive management

Conservation Action Planning

What to do?

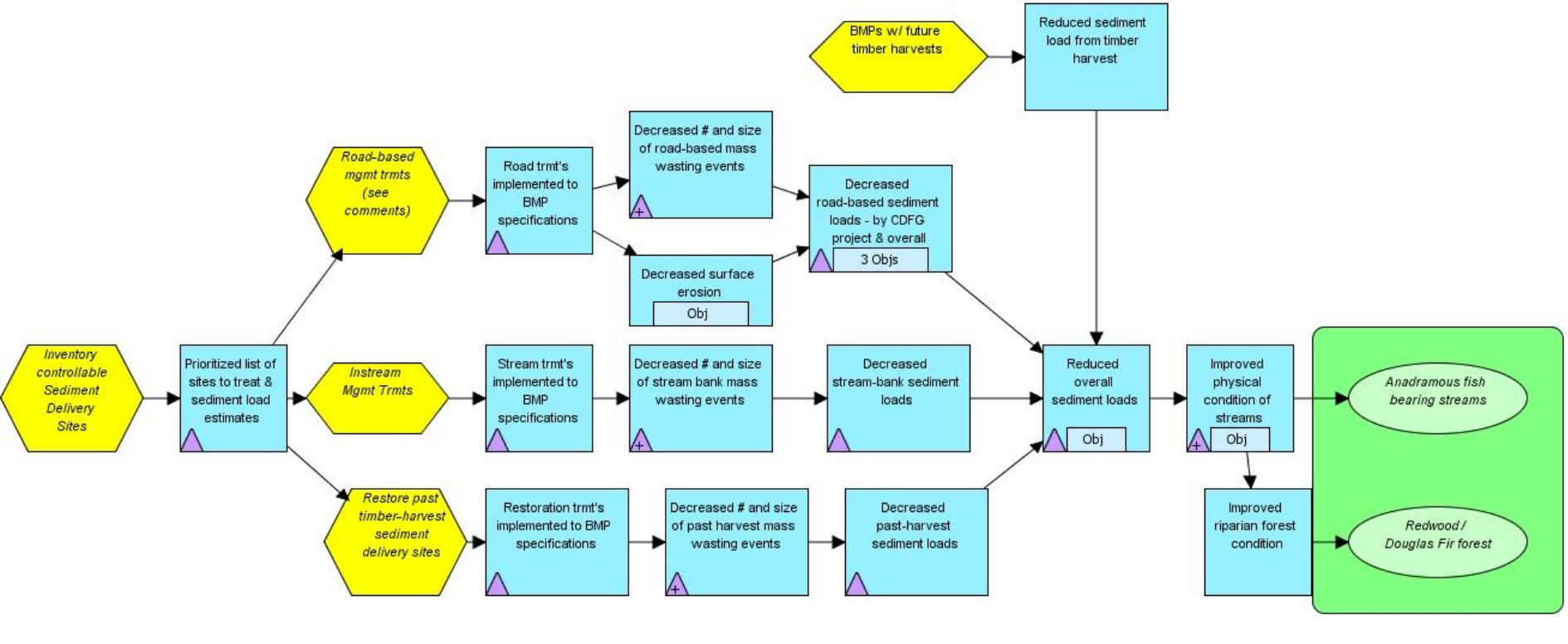
- Smaller set of targets
- Viability, threats, strategies





Results chains

Conservation Action Planning



Results chains
(Garcia River Forest example)

A7

The Nature Conservancy
SAVING THE LAST GREAT PLACES ON EARTH

Conservation Action Planning Workbook

A tool for developing strategies, taking action, and measuring success

 Version: CAP_v5a July 3, 2007

ConserveOnline Help

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To change the table format, double-click on the table header. A table format form will appear.

Project and Conservation Targets

Project	Garcia River Forest
Target #1	Anadromous Fish Bearing Stream
Target #2	Redwood/Douglas-fir Forest
Target #3	Oak Woodland/Grassland
Target #4	Non-Riverine Freshwater Systems
Target #5	Northern Spotted Owl
Target #6	
Target #7	
Target #8	

Summary of Threats

Click the page-down icon ▼to the right to view more summary tables.

Garcia River Forest

	Threats Across Targets	Anadromous Fish Bearing Stream	Redwood/ Douglas-fir Forest	Oak Woodland/ Grassland	Non-Riverine Freshwater Systems	Northern Spotted Owl				Overall Threat Rank
	Project-specific threats	1	2	3	4	5	6	7	8	
1	Forestry practices	Very High	High	Medium	-	-	-	-	-	High
2	Development of roads	Very High	Medium	-	-	-	-	-	-	High
3	Fire suppression	-	Medium	Very High	-	-	-	-	-	High
4	Invasive/alien species	-	-	High	-	-	-	-	-	Medium
5	Management for certain species (Douglas-fir)	-	-	High	-	-	-	-	-	Medium
6	Construction of ditches, dikes, drainage or diversion systems	Medium	-	-	-	-	-	-	-	Low
7	Operation of drainage or diversion systems	-	-	-	-	-	-	-	-	-
8		-	-	-	-	-	-	-	-	-
9		-	-	-	-	-	-	-	-	-
10		-	-	-	-	-	-	-	-	-
11		-	-	-	-	-	-	-	-	-
12		-	-	-	-	-	-	-	-	-
13		-	-	-	-	-	-	-	-	-
14		-	-	-	-	-	-	-	-	-
15		-	-	-	-	-	-	-	-	-
16		-	-	-	-	-	-	-	-	-
Threat Status for Targets and Project		Very High	Medium	High	-	-	-	-	-	Very High *

At what scale do you measure your indicators?

- Field inventory and remote sensing needed
- Long-term monitoring needed for trends

	Secondary Questions	Scale	Attribute	Indicators	Metrics	Associated Metrics	Used by:	Recommended by:	Timeframe
1	What is the distribution of tree species across the forested landscape? What tree species are increasing or decreasing in ecological importance?	Landscape & Stand	Species Composition/ Dominance	Tree abundance (per species)	**2,3,5,9,** & 1	Trees (number of stems), Basal Area (sq. ft.), Gross volume (cu. ft.), Gross biomass (pounds), Area (ac)	USFS,		10 yr resample (ellsworth, other TNC) Response speed: ~1 yrs (fast) Early warning potential: < 3yrs
		Stand	Heterogeneous Overstory Canopy Structure	Tree size & density			USFS (I assume), multiple TNC projects, I'd think all forest management projects	Manomet: High Scientific Basis; Low scientific Opinion (<50%)	
2	What are growth and mortality rates overall and for individual species and how are these rates changing?	Stand	Ecosystem Function	Tree growth and mortality rates (overall/per species)	**11,17,** & 12,13,18,19	Growth: all live (cu. ft.), Mortality: all live (cu. ft.), Growth: growing stock (cu. ft.), Growth: growing stock (bd. ft.), Mortality: growing stock (cu. ft.), Mortality:	USFS	USFS FMU Sustainability Monitoring (2002),	10 yr resample
	What are growth and mortality rates overall and for individual species and how are these rates changing?	Stand	Heterogeneous Overstory Canopy Structure	Tree diameter growth (overall(average?)/per species)		Diameter (dbh) and varienty of size classes - is this the same as #17	USFS (I assume)		
3	What is the condition/health of tree species? What is the degree of pest/pathogen damage?	Stand	Heterogeneous Overstory Canopy Structure	Tree condition (per species)	**2,3,5,11,17**, & 4,9	Trees (number of stems), Basal Area (sq. ft.), Gross volume (cu. ft.), Growth: all live (cu. ft.), Mortality: all live (cu. ft.), Net volume (cu. ft.),	USFS		10 yr resample
4	What is the crown condition of tree species?	Stand	Heterogeneous Overstory Canopy Structure	Crown condition (per species)	**2,3,5,11,17**, & 4,9	Trees (number of stems), Basal Area (sq. ft.), Gross volume (cu. ft.), Growth: all live (cu. ft.), Mortality: all live (cu. ft.), Net volume (cu. ft.), Gross biomass (pounds) - These seem wrong. From FIA Fact sheet	USFS, TNC (crown class; not use all measurements like FIA)		10 yr resample
5	Are forests replacing themselves? What factors are impacting regeneration?	Stand	Heterogeneous Overstory Canopy Structure	Tree regeneration	**2,** & 1	Trees (number of stems), Area (ac)	USFS		10 yr resample
16	Are we gaining or losing forest land? What is	Landscape	Heterogeneous	Landcover (same as	**1,**	Area (ac)	USFS, TNC/Ellsworth		if do early tinning of DF, can

LCFS and Biodiversity

- In terms of biodiversity conservation, many of the issues with LCFS are similar to other types of extraction
- Regional conservation planning can help identify priority areas
- It is possible to integrate measurable biodiversity standards into LCFS guidelines

Example of Regional Priority Setting

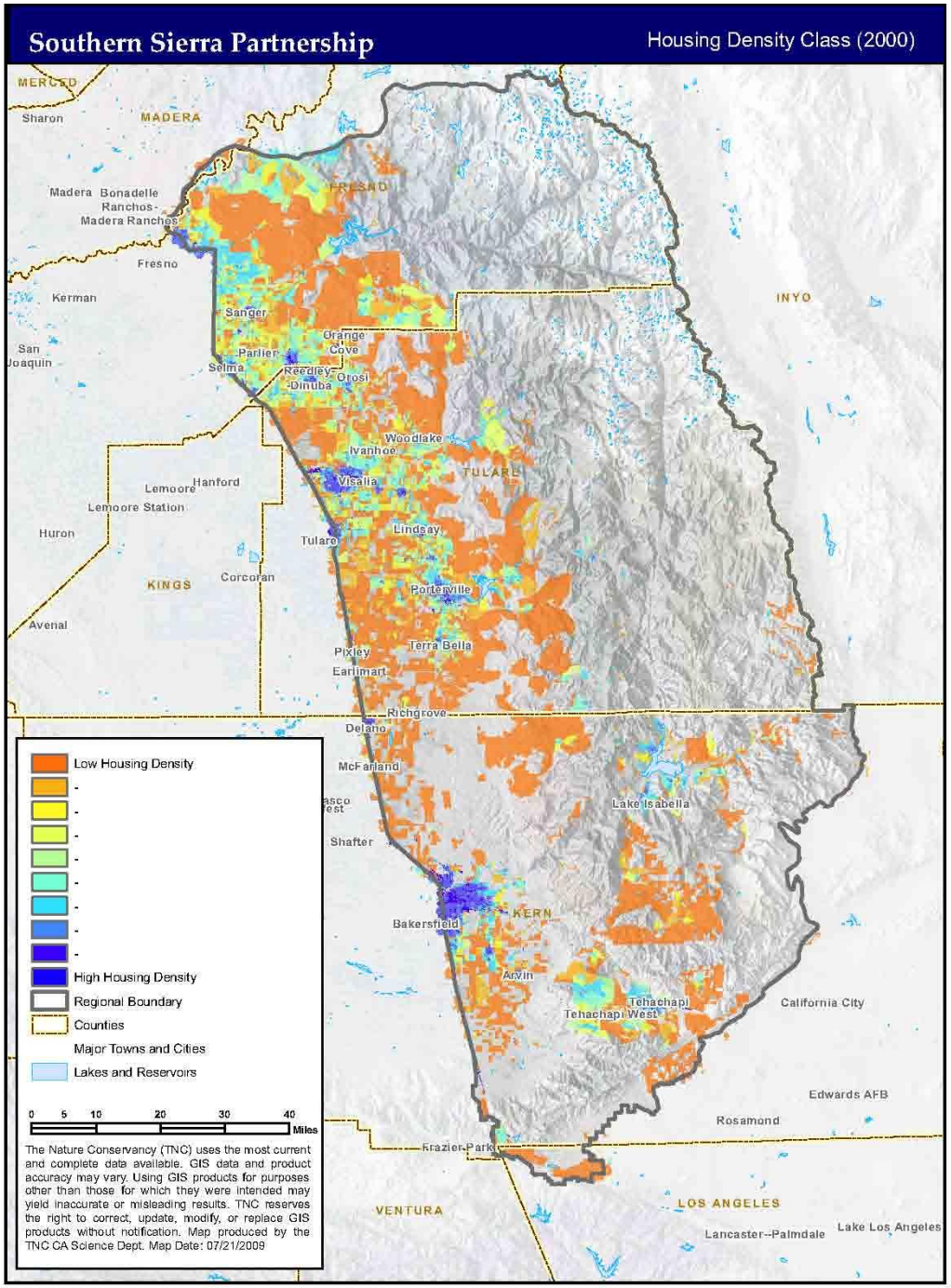
Goal of Southern Sierra Partnership Regional Analyses

- Provide context for more local priority-setting
- Assess broader distribution of targets and threats
- Consistently characterize response of targets to climate change at a relevant scale
- Represent ecosystem service values and dynamics
- Identify priority conservation areas

What is the current distribution of threats, suitability factors?

- What factors constrain/enable successful conservation and restoration?
- Composite index combining
  - Housing density
  - Road density
  - Converted agricultural land

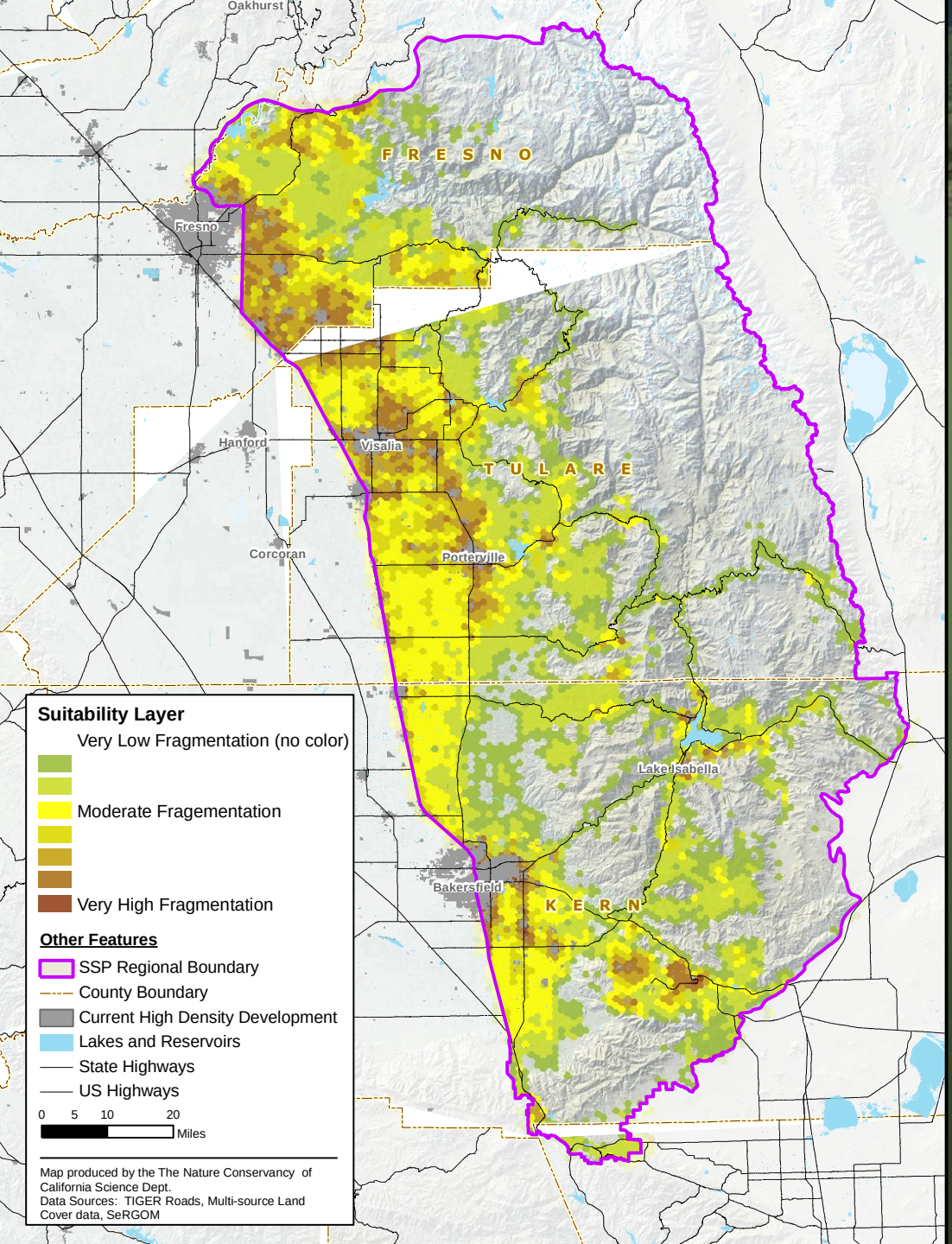
Summarized by 250 ha hexagon planning unit



Housing Density

-Source: Spatially-explicit regional growth model (Theobald 2005)

-Primary factor in suitability/integrity layer



Suitability

- Used by Marxan to meet goals in areas that are more intact

- Skewed toward more irreversible factors

-Assumes conservation management is more feasible and sustainable in areas that are not already degraded

Key Issues

Targets

are they well-mapped? Do any data gaps need to get filled?

Goals

Reasonable criteria to set goals? Stratification suitable for all targets

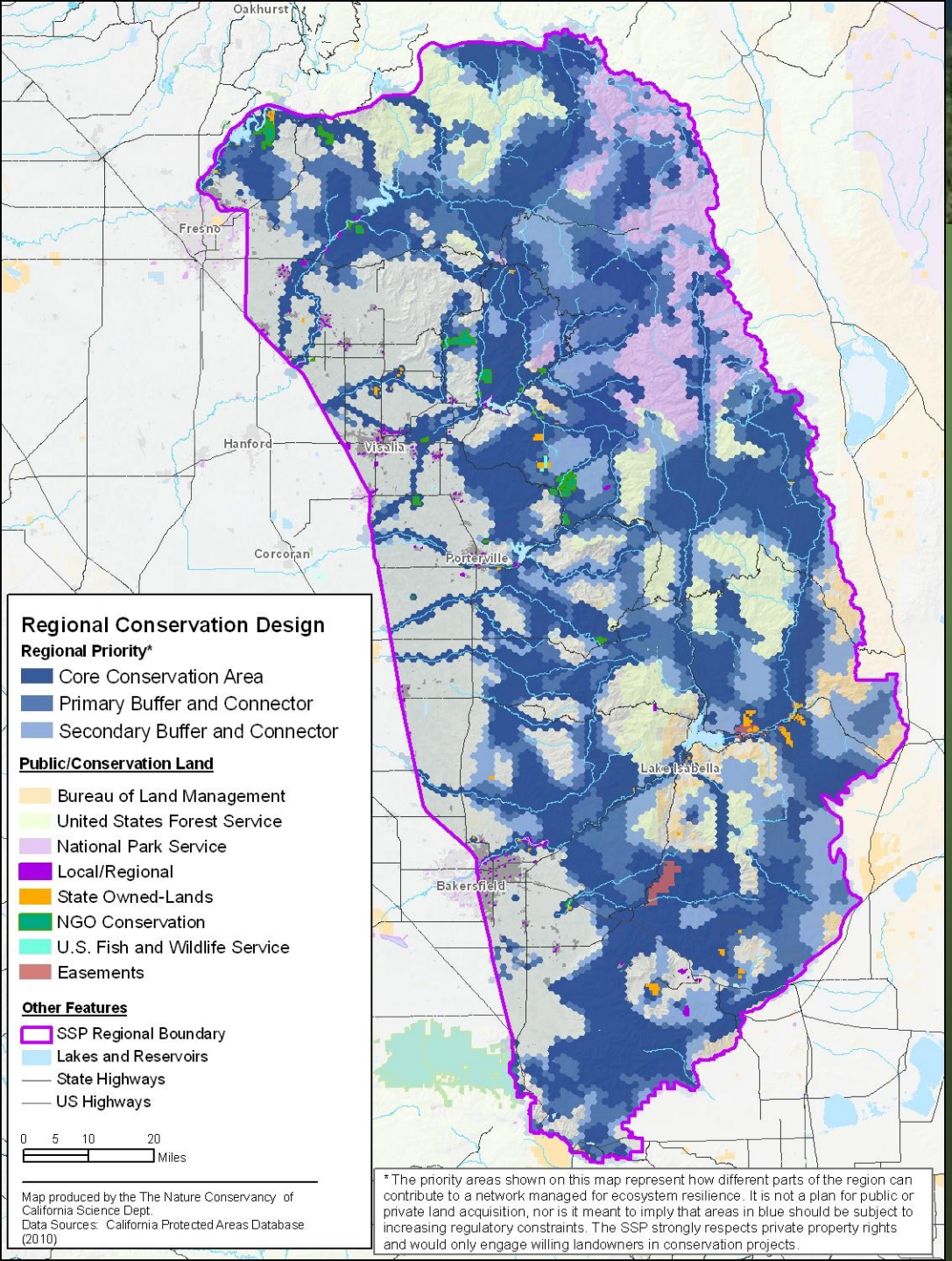
Suitability

Includes the right factors? Weighted appropriately

Lock-ins

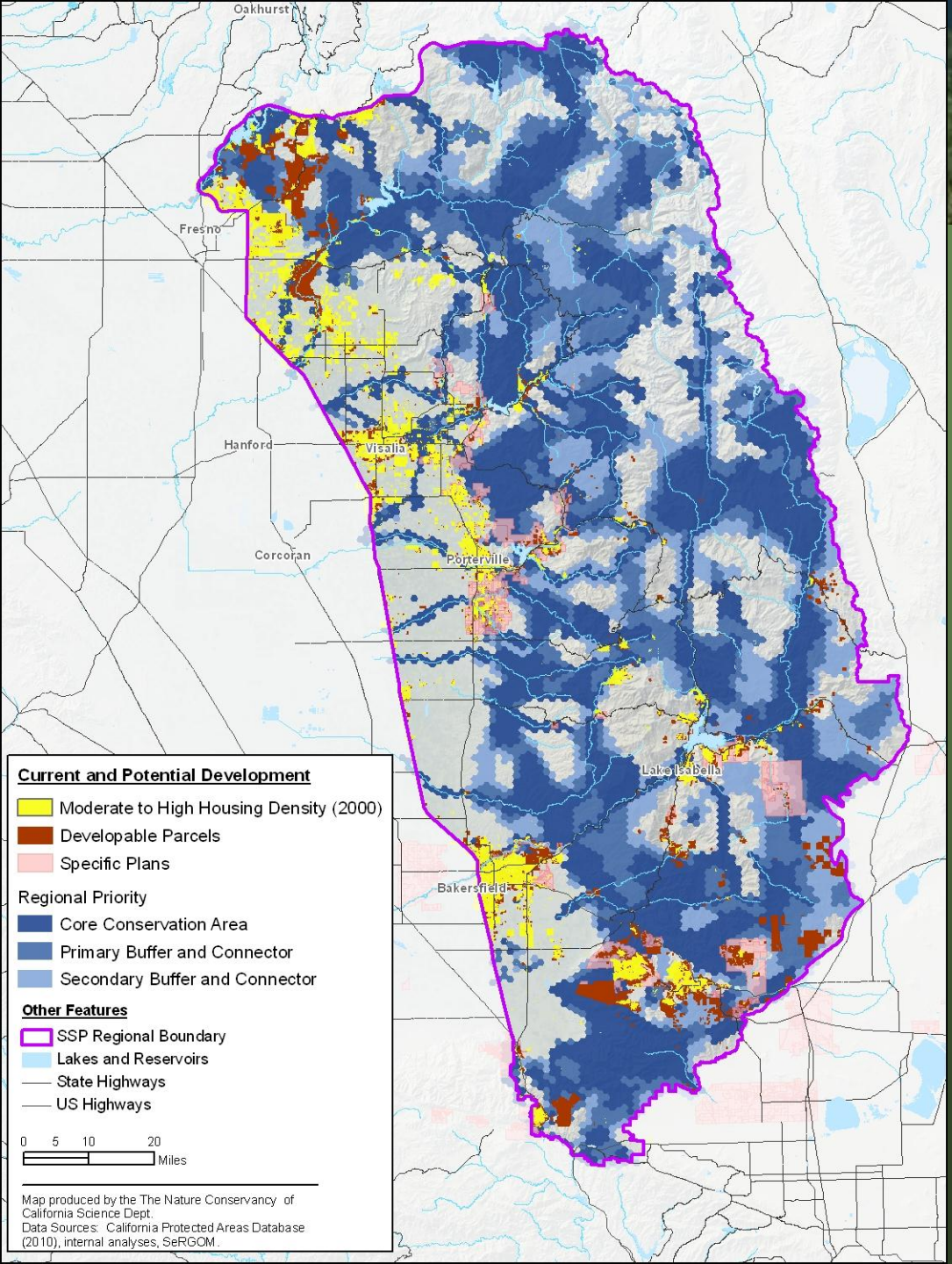
What areas need to be a part of set of conservation lands?

Regional Conservation Design



- Based on overlap of four inputs
- Edited to account for expert input
- Hypothesis of what it will take to conserve biodiversity in future

Threat of residential development



- Based on zoning designation and proposed plan amendments

- Potential to fragment some north-south foothill linkages

- Gives sense of leverage for land use planning strategy